

Weekly Activities Summary
Amendment 2 - Full Scale Field Demonstration
Interim Combined Acid Drainage Treatability Study Work Plan
Leviathan Mine Site
Alpine County, California

Week: July 22 – July 28, 2017

The following text describes field activities conducted during July 22 through July 28, 2017, to implement Amendment No. 2 to the Interim Combined Acid Drainage Treatability Investigation Work Plan, which Atlantic Richfield submitted to U.S. EPA on March 31, 2017.

INTERIM COMBINED TREATMENT OPERATIONS

OPERATIONAL SUMMARY

- During the period of July 22, 2017, through July 26, 2017, the HDS Treatment Plant continued treating Pond 4 influent (comprised of Upper Ponds water previously conveyed to Pond 4 and mixed with CUD/DS water) at a constant flow rate of 100 gpm to maintain operational stability while minor system modifications were evaluated. At approximately 11:15 AM on July 26, 2017, through July 28, 2017, the HDS Treatment Plant was shut down and the following modifications were implemented:
 - Installation of two treated effluent water jets to improve lime and sludge mixing in the Lime/Sludge Mix Tank and to prevent lime shelf formation on the sidewalls of the tank;
 - Installation of cleanouts / access points on the sludge recycle lines to improve ease of maintenance;
 - Installation of cleanouts / access points on the sludge waste lines to improve ease of maintenance; and
 - Installation of a fresh water line into the flocculant dilution manifold to allow for use of fresh water instead of treated effluent to prevent scale build-up in the flocculant dilution line. The modifications as installed provide greater operational flexibility and allow for use of: fresh water only, a blend of fresh water and treated effluent, or only treated effluent for flocculant dilution.
- During the HDS Treatment Plant shutdown, various process tanks, pumps, pipelines, and valves were inspected and/or cleaned as necessary.
- Capture and conveyance of the CUD and DS flows to Pond 4 for storage and subsequent HDS treatment occurred uninterrupted during the HDS Treatment Plant shutdown. Upper Ponds water was not conveyed to Pond 4 during this period.

- The above noted modifications were completed on July 28, 2017. The HDS Treatment Plant was restarted to fill the process tanks, and was placed in standby mode overnight.
- On July 28, 2017, Atlantic Richfield resumed transferring water from Pond 2S and mixing with CUD, DS and Leviathan Creek water (as necessary) in Pond 4 to achieve a blend of untreated water within the 2,600 – 2,900 mg/L acidity target.
- Atlantic Richfield plans to resume HDS Treatment Plant operations at a treatment flow rate of 143 gpm during the week of July 31, 2017, and continue the field demonstration and operate the HDS Treatment Plant within the target criteria specified in the work plan for 30-days (approximately August 31, 2017). Atlantic Richfield will perform daily effluent sampling on each of the first seven days after the treatment flow rate returns to 143 gpm.

HDS TREATMENT PLAN OPERATIONS SUMMARY

- HDS Treatment Plant operations experienced the following short-term interruptions between July 22 and July 28, 2017:
 - Approximately 18 hours and 50 minutes on July 23 and July 24, 2017, due to low reactor pH. During this interruption, the K-tron Lime Feeder belts were replaced, and maintenance was completed on the process blowers.
 - The HDS Treatment plan was shut down for approximately 69 hours and 58 minutes on July 26 through July 29, 2017, to implement the HDS Treatment Plant equipment modifications described above. During this shutdown miscellaneous maintenance and cleaning were also performed.
- The HDS Treatment Plant was placed in recycle mode returning effluent to Pond 4 following short-term interruptions between July 22 and July 28, 2017:
 - Approximately 2 hours and 20 minutes on July 24, 2017, following the low reactor pH shutdown and K-tron belt replacement.
 - Approximately 1 hour and 22 minutes on July 24, 2017, due to an observed increase in reactor and effluent pH caused by a shelf of lime forming in the lime/sludge mix tank falling into the reactor tank.
 - Approximately 1 hour and 10 minutes on July 28, 2017, after the reactor tank and lime sludge mix tank were filled after cleaning and maintenance, in preparation for plant startup on July 29, 2017.
 - Approximately 1 hour and 27 minutes on July 29, 2017, after the plant was restarted following maintenance, cleaning, and completing plant modifications.
- The remainder of the time, the HDS Treatment Plant was discharging to Leviathan Creek.
- Capture and conveyance of the CUD and DS were maintained uninterrupted throughout this period.

SAMPLING SUMMARY

- HDS Treatment Plant ICT sampling was performed on July 26, 2017, prior to the HDS Treatment Plant shutdown. No further samples were collected this week due to the shutdown.
- Sampling results received to date are provided in Table 1. The July 11, 12, 19, 20, and 26, 2017, sample results have not been received from the laboratory and will be provided in the weekly report once received. A summary of the HDS Treatment Plant effluent field monitoring is presented in Table 2. Flow volumes recorded for the Channel Underdrain, Delta Seep, Leviathan Creek diversion, Upper Pond water transfer, and treated water discharged from the HDS Treatment Plant are included in Table 3. An Interim Combined Treatment operational summary is presented in Table 4.
- Atlantic Richfield will perform daily sampling for a period of at least one week upon resuming the field demonstration at the target criteria specified in the work plan.

SLUDGE DISPOSAL SUMMARY

- Five sludge bins totaling 40,379 kilograms, approximately 68 cubic yards, were disposed of off-site at US Ecology in Beatty, NV on July 19, 2017.
- Three sludge bins totaling 20,575 kilograms, approximately 39 cubic yards, were disposed of off-site at US Ecology in Beatty, NV on July 24, 2017.
- Three sludge bins totaling 13,227 kilograms, approximately 35 cubic yards, were disposed of off-site at US Ecology in Beatty, NV on July 26, 2017.
- Sludge wasting volumes during operation are also included in Table 4.



TABLE 1
HDS TREATMENT PLANT - PRELIMINARY INTERIM COMBINED TREATMENT SAMPLE RESULTS
Leviathan Mine Site
Alpine County, California
Draft - Provisional Data

Parameter	Basis	July 07, 2017 HDSICT-1 HDS Influent mg/L	July 07, 2017 HDSICT-2 HDS Effluent mg/L	July 10, 2017 HDSICT-1 HDS Influent mg/L	July 10, 2017 HDSICT-2 HDS Effluent mg/L	July 10, 2017 UPCS-2 mg/L	July 11, 2017 HDSICT-1 HDS Influent mg/L	July 11, 2017 HDSICT-2 HDS Effluent mg/L	July 11, 2017 UPCS-2 mg/L	July 12, 2017 HDSICT-1 HDS Influent mg/L	July 12, 2017 HDSICT-2 HDS Effluent mg/L	July 12, 2017 UPCS-2 mg/L	July 13, 2017 HDSICT-1 HDS Influent (mg/L)	July 13, 2017 HDSICT-2 HDS Effluent (mg/L)	July 13, 2017 UPCS-2 (mg/L)
pH (s.u.) ¹	Field	2.76	7.64	2.68	7.91	2.42	NA	NA	NA	NA	NA	NA	2.71	8.18	2.45
Aluminum	Dissolved	250	<1.0	160	0.57	490	NA	NA	NA	NA	NA	NA	250	0.68	540
Arsenic	Dissolved	2.6	0.0017	0.68	0.0019	7.6	NA	NA	NA	NA	NA	NA	2.4	0.0016	8.6
Cadmium	Dissolved	0.037	0.00028 J	0.022	<0.001	0.089	NA	NA	NA	NA	NA	NA	0.035	<0.001	0.091
Calcium	Dissolved	300	1000	310	1000	190	NA	NA	NA	NA	NA	NA	310	1500	220
Chloride	Total	6.7	2.6	2.9	1.9	4.9	NA	NA	NA	NA	NA	NA	12	<10	12
Chromium	Dissolved	0.38	<0.002	0.3	0.00091 J	1.4	NA	NA	NA	NA	NA	NA	0.53	<0.002	1.4
Copper	Dissolved	1	0.0014 J	0.81	0.0038	3.2	NA	NA	NA	NA	NA	NA	1.1	0.0044	2.9
Hardness	Dissolved	1000	2800	1000	2800	740	NA	NA	NA	NA	NA	NA	1100	3500	810
Iron	Dissolved	610	<1.0	440	<0.50	960	NA	NA	NA	NA	NA	NA	630	<0.50	1200
Lead	Dissolved	0.0021	<0.001	<0.005	<0.001	<0.02	NA	NA	NA	NA	NA	NA	<0.005	<0.001	<0.01
Magnesium	Dissolved	80	110	78	77	61	NA	NA	NA	NA	NA	NA	85	77	76
Nickel	Dissolved	2.5	0.15	3.1	0.1	5.8	NA	NA	NA	NA	NA	NA	3.2	0.05	5.4
Selenium	Total	0.0089	0.002	0.0084	0.0019 J	0.012	NA	NA	NA	NA	NA	NA	0.0044 J	0.0021	0.0067 J
Sulfate	Total	4100	3000	3000	2700	5900	NA	NA	NA	NA	NA	NA	3700	2800	6200
Zinc	Dissolved	0.73	0.0064 J	0.71	0.0028 J	1.4	NA	NA	NA	NA	NA	NA	0.82	0.003 J	1.3
Acidity	Total	2800	<2.0	2200	<2.0	5300	NA	NA	NA	NA	NA	NA	2800	<2.0	5700
Alkalinity (Bicarbonate)	Total	<4.8	37	<4.8	13	<4.8	NA	NA	NA	NA	NA	NA	<4.8	10	<4.8
Alkalinity (Carbonate)	Total	<2.4	<2.4	<2.4	<2.4	<2.4	NA	NA	NA	NA	NA	NA	<2.4	<2.4	<2.4
Alkalinity (Hydroxide)	Total	<1.4	<1.4	<1.4	<1.4	<1.4	NA	NA	NA	NA	NA	NA	<1.4	<1.4	<1.4
Alkalinity (Total)	Total	<4.0	30	<4.0	11	<4.0	NA	NA	NA	NA	NA	NA	<4.0	8.5	<4.0
Total Dissolved Solids	Total	5800	4400	4700	4500	9100	NA	NA	NA	NA	NA	NA	5800	5200	9500
Total Suspended Solids	Total	44	36	110	16	28	NA	NA	NA	NA	NA	NA	52	6.3	32

Notes:
1. pH values are field measurements and are reported in standard units.
2. Discharge criteria and basis for maximum and average values are listed in the Request for Approval of Modification to the Removal Action at the Leviathan Mine Memorandum (U.S. EPA, 2008).
3. pH setpoint in the Reactor Tank was increased from 8.0 to 8.3 on July 13, 2017. The increase occurred prior to sample collection.

Abbreviations:
< - Constituents that were not detected are listed as "<" and the reporting limit is shown.
J - Results noted with "J" are an estimated value or were less than the reporting limit but greater than or equal to the method detection limit.
mg/L - milligrams per liter
NP - Not Promulgated



TABLE 1
HDS TREATMENT PLANT - PRELIMINARY INTERIM COMBINED TREATMENT SAMPLE RESULTS
Leviathan Mine Site
Alpine County, California
Draft - Provisional Data

Parameter	Basis	July 14, 2017 HDSICT-1 HDS Influent (mg/L)	July 14, 2017 HDSICT-2 HDS Effluent (mg/L)	July 14, 2017 UPCS-2 (mg/L)	July 19, 2017 HDSICT-1 HDS Influent mg/L	July 19, 2017 HDSICT-2 HDS Effluent mg/L	July 20, 2017 HDSICT-1 HDS Influent mg/L	July 20, 2017 HDSICT-2 HDS Effluent mg/L	July 26, 2017 HDSICT-1 HDS Influent mg/L	July 26, 2017 HDSICT-2 HDS Effluent mg/L	Maximum Discharge Criteria ² (mg/L)	Average Discharge Criteria ² (mg/L)
pH (s.u.) ¹	Field	2.62	8.19	2.41	NA	NA	NA	NA	NA	NA	6.0 - 9.0	-
Aluminum	Dissolved	310	0.48 J	690	NA	NA	NA	NA	NA	NA	4	2.0
Arsenic	Dissolved	2.5	0.0026	9.2	NA	NA	NA	NA	NA	NA	0.340	0.15
Cadmium	Dissolved	0.037	<0.001	0.087	NA	NA	NA	NA	NA	NA	0.0090	0.004
Calcium	Dissolved	360	1400	260	NA	NA	NA	NA	NA	NA	-	-
Chloride	Total	12	<10	12	NA	NA	NA	NA	NA	NA	-	-
Chromium	Dissolved	0.41	<0.002	1.5	NA	NA	NA	NA	NA	NA	0.970	0.31
Copper	Dissolved	0.88	0.001 J	3.3	NA	NA	NA	NA	NA	NA	0.026	0.016
Hardness	Dissolved	1400	3900	930	NA	NA	NA	NA	NA	NA	-	-
Iron	Dissolved	760	<0.50	1400	NA	NA	NA	NA	NA	NA	2	1.0
Lead	Dissolved	0.0018	<0.001	0.0042	NA	NA	NA	NA	NA	NA	0.136	0.005
Magnesium	Dissolved	100	68	99	NA	NA	NA	NA	NA	NA	-	-
Nickel	Dissolved	2.5	0.049	6.4	NA	NA	NA	NA	NA	NA	0.84	0.094
Selenium	Total	<0.02	0.0028	0.0057 J	NA	NA	NA	NA	NA	NA	NP	0.005
Sulfate	Total	4200	3600	6800	NA	NA	NA	NA	NA	NA	-	-
Zinc	Dissolved	0.74	<0.02	1.1	NA	NA	NA	NA	NA	NA	0.21	0.21
Acidity	Total	3100	<2.0	5800	NA	NA	NA	NA	NA	NA	-	-
Alkalinity (Bicarbonate)	Total	<4.8	9.5	<4.8	NA	NA	NA	NA	NA	NA	-	-
Alkalinity (Carbonate)	Total	<2.4	<2.4	<2.4	NA	NA	NA	NA	NA	NA	-	-
Alkalinity (Hydroxide)	Total	<1.4	<1.4	<1.4	NA	NA	NA	NA	NA	NA	-	-
Alkalinity (Total)	Total	<4.0	7.8	<4.0	NA	NA	NA	NA	NA	NA	-	-
Total Dissolved Solids	Total	6000	4200	9300	NA	NA	NA	NA	NA	NA	-	-
Total Suspended Solids	Total	43	240	10	NA	NA	NA	NA	NA	NA	-	-

TABLE 2
HDS TREATMENT PLANT - EFFLUENT FIELD MONITORING
Leviathan Mine Site
Alpine County, California
Draft - Provisional Data

Date	Time	HDS Treatment Plant Effluent Field Monitoring			
		Flow (gpm)	pH (s.u.)	Dissolved Iron (mg/L)	Turbidity (NTU)
07/07/17	9:25 AM	40.0	7.21	0.02	4.7
07/08/17	7:35 AM	70.0	7.50	0.44	3.8
07/09/17	7:50 AM	70.0	7.60	0.07	4.0
07/10/17	8:00 AM	70.0	7.31	0.17	15.3
07/10/17	4:30 PM	143.0	7.62	0.09	1.7
07/11/17	6:20 AM	143.0	8.05	0.58	3.0
07/11/17	6:10 PM	143.0	8.12	0.65	1.7
07/12/17	6:15 AM	143.0	7.99	0.06	2.3
07/12/17	6:00 PM	143.0	8.11	0.09	2.8
07/13/17	6:10 AM	143.0	7.96	0.11	2.6
07/13/17	6:10 AM	143.0	7.95	0.11	2.6
07/13/17	6:00 PM	143.0	8.01	0.04	2.5
07/14/17	6:50 AM	143.0	7.71	0.04	4.9
07/14/17	7:00 PM	143.0	8.35	0.57	2.1
07/15/17	7:00 PM	123.0	8.38	0.03	1.4
07/16/17	6:00 PM	100.0	8.01	< 0.03	3.7
07/17/17	6:20 AM	100.0	8.28	< 0.03	3.3
07/17/17	7:00 PM	100.0	8.18	< 0.03	2.5
07/18/17	6:15 AM	100.0	8.50	< 0.03	10.1
07/18/17	4:30 PM	100.0	7.91	0.14	2.57
07/19/17	5:15 PM	100.0	7.81	0.06	2.26
07/20/17	6:45 AM	100.0	8.06	< 0.03	3.44
07/20/17	3:50 PM	100.0	7.73	< 0.03	2.73
07/21/17	7:45 AM	100.0	8.16	0.17	4.8
07/21/17	3:00 PM	100.0	8.05	< 0.03	4.07
07/22/17	7:30 AM	100.0	8.09	0.05	3.64
07/23/17	7:00 AM	100.0	8.36	0.04	3.11
07/24/17	7:50 AM	100.0	NA	0.03	NA

TABLE 2
HDS TREATMENT PLANT - EFFLUENT FIELD MONITORING
Leviathan Mine Site
Alpine County, California
Draft - Provisional Data

Date	Time	HDS Treatment Plant Effluent Field Monitoring			
		Flow (gpm)	pH (s.u.)	Dissolved Iron (mg/L)	Turbidity (NTU)
07/25/17	8:15 AM	100.0	8.53	0.03	4.61
07/26/17	8:10 AM	100.0	8.54	0.06	7.69
07/27/17	--	--	--	--	--
07/28/17	--	--	--	--	--

Notes:

- ¹ HDS Treatment Plant influent flow rate measurements are calculated from flow totalizer volume measurements.
² Effluent pH values are field measurements and are reported in standard units.
³ Dissolved Iron values are field measurements and are reported in mg/L.
⁴ Turbidity values are field measurements and are reported in NTU.

Abbreviations:

gpm - gallons per minute
mg/L - milligrams per liter
NA - not available

s.u. - standard unit
-- - not applicable, plant not in operation
< - less than

TABLE 3
INTERIM COMBINED TREATMENT VOLUMES
Leviathan Mine Site
Alpine County, California
Draft - Provisional Data

Date	CUD Collection Volume	DS Collection Volume	Leviathan Creek Diversion Volume	Upper Pond Transfer Volume	Treated Water Discharge from HDS Treatment Plant Recorded Flow ^{1,2}	
	(gallons)	(gallons)	(gallons)	(gallons)	(gpm)	(gallons)
7/5/2017	68,619	22,957	0	115,540	0	0
7/6/2017	70,136	23,188	0	100,204	0	0
7/7/2017 ³	70,235	22,763	1,619	0	39.0	56,121
7/8/2017	70,331	22,738	0	0	70.0	100,774
7/9/2017	70,411	22,299	0	0	70.0	100,738
7/10/2017	70,542	22,242	0	35,000	109.6	157,807
7/11/2017	70,617	22,112	2,959	39,000	142.2	204,716
7/12/2017	70,413	21,686	0	57,750	142.7	205,542
7/13/2017	70,598	22,402	0	100,800	113.6	163,548
7/14/2017	70,698	22,017	6,591	84,480	84.2	121,242
7/15/2017	70,762	29,203	15,663	30,600	100.0	143,928
7/16/2017	70,790	30,773	6,199	21,000	88.7	127,786
7/17/2017	70,872	21,409	0	0	99.8	143,766
7/18/2017	70,911	20,729	0	0	99.7	143,523
7/19/2017	71,055	21,852	0	0	67.4	97,019
7/20/2017	71,083	20,656	0	0	99.4	143,175
7/21/2017	71,117	20,654	0	0	100.0	143,959
7/22/2017	71,110	20,572	0	0	100.0	143,991
7/23/2017	71,204	20,532	0	0	68.2	98,253
7/24/2017	71,273	20,317	0	0	46.0	66,283
7/25/2017	71,346	20,426	0	0	100.0	143,955
7/26/2017	71,353	20,272	0	0	46.7	67,190

TABLE 3
INTERIM COMBINED TREATMENT VOLUMES
Leviathan Mine Site
Alpine County, California
Draft - Provisional Data

Date	CUD Collection Volume	DS Collection Volume	Leviathan Creek Diversion Volume	Upper Pond Transfer Volume	Treated Water Discharge from HDS Treatment Plant Recorded Flow ^{1,2}	
	(gallons)	(gallons)	(gallons)	(gallons)	(gpm)	(gallons)
7/27/2017	71,356	19,904	622	0	0.0	0
7/28/2017	71,415	19,787	175	0	0.0	0
Average Flow Rate or Total Discharged	1,698,247	531,492	33,828	584,374	81.2	2,573,316

Notes:

1. Treated Water Discharge recorded flows are calculated from flow totalizer volume measurements.
2. The average flow rate is reported. Water discharge does not always occur 24 hours per day. The operational flow rate may also vary during the day.
3. Discharge of treated combined water from the HDS Treatment Plant started on July 7, 2017, at approximately 9:53 AM.

Abbreviations:

CUD - Channel Underdrain	HDS - High Density Sludge
DS - Delta Seep	gpm - gallons per minute

TABLE 4
INTERIM COMBINED TREATMENT OPERATIONAL SUMMARY
Leviathan Mine Site
Alpine County, California

Date	Influent Flow Setpoint (gpm)	Hours of Operation ^a	Sludge Recycle Setpoint (gpm)	Flocculant Dosage Setpoint (ppm)	Reactor Tank pH ^b (s.u.)	Effluent Tank pH ^b (s.u.)	Effluent Turbidity ^c (NTUs)	Lime Utilization ^d (g/L)	Sludge Waste (gallons)	Sludge Disposed (kg)
7/22/2017	100	24.0	25	2.4	8.30	8.24	2.68	1.64	861	0
7/23/2017	100	16.3	25	2.4	8.12	8.05	3.59	1.73	1290	0
7/24/2017	100	12.5	25	2.4	8.16	8.00	6.75	1.27	646	20575
7/25/2017	100	24.0	25	2.4	8.60	8.61	5.34	1.56	1253	0
7/26/2017	100	11.1	25	2.4	8.60	8.61	7.50	1.29	1253	13227
7/27/2017	--	--	--	--	--	--	--	--	--	--
7/28/2017	--	--	--	--	--	--	--	--	--	--

Notes:

^a The hours of operation are when the HDS Treatment Plant is actively discharging to Leviathan Creek.

^b The average of the in-line pH probe measurements is presented. The Reactor Tank pH set point is 8.3 s.u. except for 7/24/17 through 7/27/16 where it was increased to 8.6 s.u. because the HDS Treatment Plant was treating primarily Channel Underdrain and Delta Seep water.

^c The average of the in-line turbidity meter measurements is presented.

^d The field lime utilization test result is presented.

Abbreviations:

-- = not measured or not applicable

g = gram

gpm = gallon per minute

kg = kilogram

L = liter

ppm = part per million

s.u. = standard unit